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File RD-27-

Task II 50X1

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December 14, 1953

Subject:

Contract RD-27
Task II - Additional Program

Dear

Reference is made to our November 4, 1953 conference at which [] was requested to make a rough estimate for budgeting purposes, of the costs for product development of receiver equipments to meet the performance specifications set forth in the enclosed [] Specification.

We estimate the cost to the Government for the building of ten (10) preproduction models conforming to the requirements of the enclosed specification would be some [] This estimate is based upon start of work early in 1954 under which schedule delivery of models would start within twelve (12) months from contract authorization and to be completed within sixteen (16) months. Components designed for production, but not made from production tools, would be used in the fabrication of these preproduction equipments.

The above estimates are submitted only as an aid in your budgeting for a possible production program and are not to be considered as a firm commitment on [] part at this time. We will be pleased to submit a firm formal proposal at such time as you desire.

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[Redacted]

As we are anxious to firmly schedule our engineering effort for the forthcoming year, we will appreciate an indication of your interests in the above at your earliest convenience.

Should additional information be desired in regard to the project, please address the undersigned. [Redacted]

[Redacted]

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Very truly yours,

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[Redacted]

Manager
Government Contracting

Encl. [Redacted] Specification

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Specification

FREQUENCY COVERAGE: 3.0 to 12.0 mcs in two bands

A.M. SENSITIVITY: 15 microvolt signal (mod. 30%) will produce a 1.0 milliwatt output into 4000 ohm load.

SIGNAL-TO-NOISE RATIO: 15 microvolt signal (mod. 30%) will increase receiver output power 10 db over residual noise output.

IMAGE REJECTION RATIO: 30 db

I.F. REJECTION RATIO: 60 db

L.O. RADIATION: Less than 1000 microvolts/meter (JAN I-225)

B.F.O. RADIATION: Less than 1000 microvolts/meter (JAN I-225)

FREQUENCY CALIBRATION: As high as can reasonably be obtained.

DIAL RESETABILITY: Extremely critical. Less than 0.1% error

FIDELITY: Overall frequency response shall be within ± 3 db for modulation frequencies between 250 and 3000 cps.

SIZE: 6 1/4 x 3 3/8 x 2 1/4 inches INCLUDING BATTERIES

BATTERY SUPPLY: Mercury batteries within the receiver case shall be capable of 25 hours operation before the receiver sensitivity is reduced to one-half.

ADDITIONAL CONSIDERATIONS: Case shall have a flush form factor (i.e. when the unit is stowed, it will have no projecting knobs, terminals, or controls).
Set shall be capable of withstanding vibration shock, acceleration, and pressure normally encountered in transportation and drop of similar equipment.
Set shall be able to operate reliably and be stored indefinitely in a tropical environment without failure due to such environment.
Covers to seal set against dust, spray, and wind shall be provided, if feasible.
Reliable operation at temperatures between -40 - and +40°C.

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DESCRIPTIVE SPECIFICATION

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(Revised)

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1. Purpose of the Proposed Work

The purpose of the proposed work is to investigate and develop transistor circuitry for use in a transmitter-receiver equipment, using as a guide the government specification entitled "Development of a Transistor Radio Set", dated Feb. 25, 1952, and assigned

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2. Summary of Proposal

The contractor is to make certain studies and supply reports as detailed below. No operating models are to be supplied.

A. The objectives of the studies under this project may be summarized as follows:

- 1) To determine the electrical characteristics of available types of transistors for application to this project.
- 2) To determine to what degree transistors may be used in the various circuits and the best circuitry for the use of transistors in a receiver and transmitter as described in the Government specification entitled "Development of a Transistor Radio Set", Dated 25 February 1952, as well as the characteristics of new types of transistors that might be needed to meet the operational requirements of the circuits mentioned above.
- 3) To determine the most practical overall circuit configuration for the transmitter and receiver using transistor circuits wherever possible as mentioned in paragraph A. 2) above.

B. The results of the studies are to be reported as follows:

- 1) Nine Bimonthly reports on progress of the studies.

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- 2) A final report, on details of the study, conclusions of the study, and recommendations for further study or development work where needed.

3. Detailed Description of Studies to be Undertaken

A. Broad Subdivisions of the Project ,

This study shall consist of three phases that will, in general, proceed simultaneously, with more emphasis at first on the phases which appear most feasible in view of the types of transistors then available.

- 1) Electrical characteristics of available transistor types
- 2) The transistor as a component in circuits
- 3) Problems of integration of the specific circuits to meet performance requirements.

B. Detailed breakdown of study program.

The study program will be divided in general as indicated in paragraph 3A. Several of these categories will need further breakdown to allow groups or persons best suited to work on each phase of the problem.

- 1) Electrical Characteristics of Transistors: This study can be divided into parts as follows:
 - (a) Securing of manufacturers' data.

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(b) Noise measurements under proposed operating conditions.

(c) Measurements of input and output characteristics under proposed operating conditions.

(d) Measurement of effects of ambient temperature on transistor characteristics under the proposed circuit conditions.

(f) Determination of frequency limitations

2) The Transistor as a Component in Circuits: This portion of the project is concerned with the selecting of best electrical networks for use with available transistors as circuit components. Consideration will be given to the network configurations already proposed as well as newly made circuit proposals. A part of the problem is the use of components other than transistors with physical characteristics which are satisfactory for the proposed application. The problems to be considered in this portion of the evaluation are as follows:

(a) Audio Amplifier Investigation

Means for efficient and space-saving coupling need to be determined. Present means depend upon miniature iron-cored transformers.

(b) Detector Problems

Obtaining of desirable detection characteristics while coupling into a load of comparatively low impedance may require the use of a transistor as an impedance

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transformer.

(c) IF Amplifier with AGC

The following investigation may be followed:

- (1) Minimum noise circuits
- (2) Gain Stability with temperature
- (3) Automatic gain control methods to prevent overload
of the system over the range of input signals.

(d) V.F.O. and Converter Problems

Some lines of investigations which may be taken are:

- (1) Determination of suitability of phase oscillator circuits
to cover the required frequency ranges.
- (2) Development of other oscillator circuits.
- (3) Determination of feasibility of maintenance of 1%
dial calibration specification with transistor circuitry.

(e) R-F Amplifier Evaluation

The problems involved in this portion of the evaluation are
as follows:

- (1) Noise limitations of the available transistor types.
- (2) Frequency characteristic limitations of available
transistors.

From the transistors which are at present available it
appears that tubes will be required for this portion of the
circuit.

(f) Crystal Stabilized Power Oscillators

At present, power and frequency requirements of the trans-

mitter appear incompatible with any single available trans-

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istor type. The possibility of there being some means of obtaining the required frequency range may permit the paralleling of several transistors to obtain the specified power. The possibility and feasibility of some such means are to be determined.

3) Problems of Integration of the Specific Circuits to Meet

Performance Requirements. Along with the programs described under 1) and 2) investigations of how to meet overall performance requirements will be made. Lines of investigation which can be followed for this study are as follows:

- (a) Applicability of printed wiring techniques.
- (b) Survey of available miniaturized components.
- (c) Development of specialized components to meet transistor circuit requirements.
- (d) Determination of temperatures which may be reached in a proposed equipment and suitable methods of dealing with operational results.

4. Reports to Be Supplied

Bimonthly reports and a final report shall be supplied as follows:

- A. Bimonthly reports shall be prepared, each report being due within 30 days following the end of the period which it covers. Ten copies of each bimonthly report shall be furnished.

These reports shall be in hecto or mimeograph form and shall contain:

6.

- 1) Table of contents
- 2) Purpose of the work
- 3) Particular problems studied and accomplished for the report period.
- 4) Summary of progress to date.
- 5) Outline of the work proposed for the next period.

B. A final report shall be provided within sixty days following the completion of the study. It shall contain the results in detail of the studies made as described above. Five copies of the final report shall be furnished in multilithograph form.

5. Equipment to Be Supplied

Breadboards which may have been built to demonstrate conclusions of the study will be available upon request.

6. Government Furnished Services

In the course of this evaluation it may be desirable to have information and samples of transistors unavailable to Government aid will be sought to obtain information and samples if found necessary. From time to time, counsel and information may be needed in connection with the investigation and development. All such help will be sought from the government agency involved.

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7. Government Furnished Equipment

"A representative model (S) Receiver-Transmitter Equipment, along with the operational specifications, shall be supplied to the contractor immediately upon execution of the contract. It is understood the the equipment will be modified or expended during the course of the project.

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8. Term of Contract

The engineering work shall be completed within 18 months from execution of the contract. The final reports shall be delivered within 60 days after completion of the engineering phase.

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